the fineness and closeness of their striæ. And though specimens of β, subvar. 1, *normalis,* occur occasionally quite as obese, yet they are generally far more slender, being always, moreover, distinguished from the present shell by their uniform dull pale-grey cinereous colour without lustre, stronger, more distinct, and remote longitudinal striæ, more acute and drawn-out spire, with the volutions slightly more convex, and suture more impressed, having also at least one more volution. Thus, as a variety of *C. deltostoma,* its proper place would be between subvar. 1 and subvar. 2 of var. β; but, if admitted as a species, it must stand between *C. deltostoma* (β, subvar. 2) and *C. exigua.* In the former case, I would propose the following fresh arrangement of the varieties or subvarieties, instead of that given in "Catal. Moll. Mad.," in the 'Proc. Zool. Soc.' 1854, part 22. p. 215:—

C. deltostoma, Lowe.

* Striis longitudinalibus remotiusculis distinctis.

α. *raricosta,* subvarr. 1 (=*C. Lowei,* Alb.), 2, *l. c.* p. 215.
β. *crebristriata,* subvar. 1, *normalis, l. c.* p. 216.

** Striis longitudinalibus confertis tenuissimis.

γ. *obesiuscula*=*C. obesiuscula* suprà.
δ. *depauperata* = *C. deltostoma,* β, subvar. 2, *depauperata, l. c.* p. 216.

I have received also from the Baron de Paiva several examples of a minute Madeiran *Vitrina,* with only two volutions, collected between S[ta] Anna and S. Jorge, in April last, which, from its globose shape and aspect, seemed at first sight possibly distinct; but, on close and careful examination, I find it to be merely the very young (*pullus*) of *V. Lamarckii,* Fér., with the very minute, puncticulate, spiral striæ which characterize the young of that species and of *V. media,* and which are also visible on the *nuclei* or two primary volutions of most adult specimens of those two species, though wanting in *V. Teneriffæ,* Q. et G.

Lea Rectory, Oct. 15, 1863.

XXXIV.—*Third Communication on the Vasa Propria, Laticiferous Vessels, &c., of Plants.* By M. T. Lestiboudois*.

It has been shown in the two preceding communications that the coloured juices of plants are contained in reservoirs extremely diversified in structure, and that these are at times anastomosing vessels constituting a network, at others straight and rigid tubes or utricles, either in rows or collected into irregular

* Translated by Dr. Arlidge from the 'Comptes Rendus' for July, 1863.

masses or meati, or vasiform or irregular lacunæ. Consequently these reservoirs cannot be said to possess the characters of a vascular system; indeed, when they have unquestionably the form of vessels at their origin and during the greater portion of their course, they are not distributed in the manner of vessels in the organs in which they terminate. It must, moreover, be added that they are not met with in the generality of plants, nor in all portions of the plant in which they may occur. For instance, they cease to exist in the roots of *Asclepias Syriaca.*

A still more remarkable condition may be seen in the *Acer campestre.* In this tree the bark of the young stems and the young branches possesses an abundant lactescent fluid, contained within wide flexuous vessels difficult of detection in consequence of their being surrounded by cells filled with rather greenish granules, not coloured blue by iodine. On tearing, however, a fragment of bark, extremely slender threads are seen interposed among the cortical fibres, and to be very extensible; these are nothing else but the laticiferous fluid itself, coagulated into a solid substance, eminently elastic, which is drawn out into very delicate filaments having various bulgings here and there, and accurately corresponding in appearance to vessels when said to be in a "*state of contraction.*" In portions of the cortical tissue of sufficient transparency, the real vessels are visible, and are seen to be very different from these fibres, and, among other things, to possess walls, which are scarcely distinguishable from the liquid they enclose. Their appearance is so singular that there is little question that they are the structures which have been described (with little precision, indeed) as the laticiferous vessels of the *Acer platanoïdes.*

The existence of vasa propria in young stems cannot certainly be called in question; but those layers of the bark which are more than three or four years old are deficient of them, and they are not discoverable in the roots. Hence in old stems and in roots, the new tissues which belong to the same formation in regard to age as do the most recent branches exhibit no traces of laticiferous juices, although these are abundant in the tissues produced in the course of the same year.

The laticiferous juice, therefore, is not an essential element in the growth of plants. It is sometimes wanting in the most essential portions of plants. It, moreover, is found in certain species, and disappears in others closely allied: thus, the *Acer platanoïdes* has a perfectly milky juice, whilst the *Acer pseudo-platanus,* which is so closely related to it, possesses juices of a perfectly limpid character. The same observation may be repeated with respect to the Umbelliferæ. Consequently the coloured juices cannot be considered agents indispensable to life: they exist or are absent in the most intimately allied species; they are wanting in the most important organs; they are enclosed in reservoirs of entirely different structure. There are certainly some vessels which appear articulated, because the constrictions they present extend so as to constitute septa, or because, when they are observed, they are broken into several pieces—a circumstance which happens because the reservoirs are originally constituted of cells united end to end. There are some which occur in the form of irregular masses; such therefore cannot be regarded as having primitively formed vessels.

These facts being beyond dispute, the opinion has been put forward that it is necessary to distinguish the coloured liquids enclosed within vessels from those contained in cells, meati, and lacunæ, and that the former alone constitute the nutritive juice and have their analogues in all plants. This brings us to the examination of the fifth and sixth questions we have propounded, and leads us to inquire, in the first instance, whether, in fact, two distinct categories of coloured juices can be instituted.

At any rate, no character can be seized upon which will serve to establish a line of demarcation between them: often the juices which are contained in vessels differ more among themselves in composition than they do from those which are found in cells. Some juices contain fatty matters, others substances of a totally different nature, such as caoutchouc; some are bland and nutritious, others are acrid and poisonous; some possess alkaloids endowed with energetic properties, others contain no such compound principles. No greater differences are met with between the liquids contained in different reservoirs. If, therefore, no indication can be discovered sufficient to distinguish one from the other, on what grounds, it may be asked, can it be asserted that some are special, secreted, excrementitial juices, and others of the nature of vital and of alimentary fluids? Such a distinction is assuredly too arbitrary.

It can with still less reason be admitted in certain plants, such as *Chelidonium*, previously cited,—where the coloured juices of the stem are contained in vessels, whilst those of the root are enclosed in cells. These juices preserve their properties in their integrity, although their receptacles differ in form and may assume the numerous configurations which are peculiar to vegetable tissues.

We have now to inquire whether it is true that in all non-lactescent plants there are vessels which constitute a capillary network such as M. Schultz has described and figured, differing only from lactescent vessels by reason of their fluid contents being limpid instead of coloured. In instituting this inquiry we encounter the most important of the problems to be solved; for if we find in all plants a system of vessels of the like kind, occupied by liquids differing only by being either limpid or else coloured, then functions of a general importance must be attributed to this vascular system, and both forms must be regarded as canals permeated by the descending sap or the nutritive juice.

The numerous observations we have made place it beyond doubt that, in the generality of non-lactescent plants, tubes are to be found filled with an elaborated liquid, in which granules are frequently to be seen in great abundance and of variable magnitude. I have found such in almost every plant in which I have sought them; for example, their presence may be descried with great facility in the Cucurbitaceæ, the thin transparent tissues of which are of large size. If a vertical slice of a fibro-vascular bundle be removed from *Pepo* after the plant has been boiled, the cortical portion of these bundles may be seen to be almost entirely formed by tubes filled with a liquid holding numerous granules in suspension. These granules are small, unequal, ill-defined in form, and sometimes of a greenish hue.

But these liquids essentially differ from the coloured juices. The latter contain caoutchouc, fatty matters, organic principles possessing properties often of singular energy, and which stand in no sort of relation to the organs with which they are associated; moreover they do not turn blue under the action of iodine. The juices of the straight tubes are simple in composition. M. Trécul has shown (Institut, No. 1487, p. 215) that the granules of the cortical fibres become blue when permeated by an aqueous solution of iodine; they therefore contain starch—a principle isomeric with cellulose, the base of all the tissues.

In relation to physical properties, the juices compared together are not less distinct: the one sort is coloured, as already stated, and the other limpid; and although the fluids of the latter description may contain granules, the appearances they present when extravasated differ from those exhibited by the former. The difference is particularly striking when the milky and the limpid juices of the bark are examined in a plant in which they are readily separated—for example, in the *Acer campestre*. If a drop of the milky juice be placed on a glass slide, it is seen that, as it dries up, it becomes progressively capable of being drawn out into very long elastic threads: when dried, it has the appearance of a uniform semitransparent mass, in which the granules cannot be detected, and which remains completely undivided and homogeneous. But if a drop of the limpid fluid be placed on the glass, it rapidly dries and breaks up in the fashion of gummy substances. The meshes produced are of smaller or larger dimensions, and anastomoses occur in an irregular manner among them, whence a resemblance (sufficient to cause deception) to a group of reticulated fibres is set up. The appearance is that of the network of a leaf. It is one of the most singular illusions that can occur under the microscope. But it may be proved that the parts which give this image of anastomotic fibres are the fissures formed in the act of desiccation of the gummy fluid: some of these appear in an instantaneous manner; others elongate themselves by their extremity, much as fissures of glass do under the influence of slight pressure. It is at times difficult to trace this formation, so great is the rapidity with which the dried substance breaks up. But the formation of this network may be readily seen by placing under the lens of the microscope a particle of dried cortical juice, lightly breathing upon it without causing displacement, and then observing it as speedily as possible. At first everything is obscure, for the moisture of the breath has destroyed the transparency of the glasses; but ere long the objects come well into view: the moisture allows the gummy substance to combine in a single mass, and the subsequent desiccation reproduces a new network, altogether different from the first. If we examine the cortical juice of young shoots, or of the aged bark of the *Acer pseudoplatanus,* which contains no milky fluid, all the phenomena exhibited by the limpid juice of *Acer campestre* are clearly shown. It therefore cannot be asserted that the limpid juices of non-lactescent plants are the analogues of the coloured fluids; they have, indeed, their analogues in lactescent plants, but not in those juices possessing a special colour and peculiar qualities. We may add that the tubes which enclose them do not resemble reticulated vessels; they especially occur in parts recently formed; they are thin, transparent, and of variable diameter; further, they do not anastomose so as to form a network, but are straight, parallel, and terminate in more or less acute points placed in apposition with other similar tubes, or else unite end to end, along a transverse line, with the tubes following them. We have observed similar tubes in the Vine, *Antirrhinum majus, Nicotiana Tabacum, Mercurialis annua, Pelargonium zonale, Cheiranthus Cheiri, Brassica oleracea,* &c.

If the tissues possessing granuliferous tubes be macerated for several days, they may afterwards be easily separated, and their characters be well explored.

If they are submitted to prolonged maceration, they become extensible, and are constricted by traction in such a way that their cavity, at certain points, is almost completely effaced, and they assume the appearance of slender threads, of which the granuliferous liquid is reduced to the appearance of a feeble streak of little corpuscles ranged in a single line. Some of these tubes present oblique or transverse articulations derived from the union of the tubes with those which are continuous with them. These tubes, by reason of their transparency, of the tenuity of their walls, of the absence of fissures (clefts) and perforations, and of the presence of granules floating in their contained fluid, resemble in some respects the vessels filled with coloured liquids; but, on the other hand, they present differences of a very decided nature. The tubes filled with milky juices are flexuose, branching, and anastomotic, whereas these others are straight, parallel, placed in close juxtaposition, and closed at their extremities, as in the plants already enumerated, and in many others we have examined—as, for instance, *Arum Italicum*, *Impatiens balsamina*, *Menyanthes trifoliata*, *Cynara Scolymus*, &c. We have observed in certain plants (for instance, in *Brassica oleracea*) the commencement of divisions of the tubes, but no anastomoses, and no indications of a complex network.

How does it happen that so skilful an observer as M. Schultz has assumed the existence of, and figured, this reticulated arrangement? Is it owing to the influence of the hypothetical system he adopted? Is it on account of the partial divisions he may have noticed? Is it because that in certain cases, where the cells have been partially destroyed by maceration, they still offer resistance to separation along their lines of junction, and exhibit a sort of network, as we have seen them do in several instances? Or is it, lastly, on account of mycodermic filaments developed in the macerating fluid, and presenting themselves in the form of transparent, ramifying, and sometimes articulating tubes, having been mistaken for structures belonging to the plant on which they were produced? We cannot reply to these queries; but in the many observations we have made and often repeated, we have failed to encounter these reticulated tubes, which have been represented as the analogues of proper vessels.

With reference to the three states of articulation, expansion, and contraction admitted by M. Schultz, these appear to me to be the consequences either of the natural structure of the tubes, or of the modes of preparation to which they have been subjected. Naturally, indeed, tubes may be articulated, since they are more or less short, and unite at intervals end to end by their rectangular extremities; they may further appear to be articulated when the walls are broken through in consequence of maceration, and the continuity of the tube is maintained by the thickened juices of its interior; the tubes, again, may appear in a state of expansion or of contraction because their diameter varies considerably in their course—and they may be either full or empty, according to circumstances. Lastly, their walls lose consistence by maceration; they are then rendered extensible, and may assume the appearance of a simple filament; indeed it is possible to mistake a streak of granule-bearing liquid, more glutinous and resistant than the walls themselves, for a tube.

These tubes, moreover, exhibit transitions to the nature of fibres, so that we see intermediate forms in every variety between fibres with thick and porous walls and nearly obliterated cavity and those whose walls are of extreme tenuity. The fibres are firm and porous in completely formed tissues, whilst their walls are less and less thick in proportion as the tissues in which they occur are more recent; hence in tissues most lately produced they exhibit that conformation which has led to their being taken for laticiferous vessels: in all these instances their extremities are formed in the same manner. The fibres not only present transitional phases in the degree of thickness of their walls, but also in the quantity of granular matter contained in their interior: this substance grows scarcer in proportion as the tubes advance in age, and as their walls augment in thickness and their cavity contracts; yet, however reduced the diameter of their cavity may be, it is rare that a certain number of granules is not found in it.

When the cavity is very distinct, the granules are often seen in abundance; but when the tissues are incompletely formed, their walls are not very evident, and the granules within are in scanty proportion.

These tubes are met with in the fibro-vascular bundles, and are not distributed in the medulla or in the parenchyma of the bark, as are the proper vessels.

To further demonstrate that these granule-bearing tubes are not identical with vasa propria, it may be noticed that they occur as well in vegetables having coloured juices as in those which have not. Thus, *Asclepias Syriaca* and other species of this genus, *Acer platanoïdes*, &c., have fibrous bundles very distinct from the proper vessels, though erroneously assumed by Mirbel to be milk-vessels, and are perfectly like the ordinary cortical fibres, and pass through all those phases just described, presenting thick walls and punctiform cavities, or thin walls and very apparent cavities, containing few or many granules. This fibrous tissue, as we have stated, accompanies the spiral bundles in the leaves. The tubes which compose it taper and decrease in length as they follow the course of the nerves in their divisions, and concur in forming the network of the leaves.

Their walls having lost their thickness, they cannot be any longer so easily distinguished in the exterior zone of the cortical fibres of the stem. However, in certain plants, as the *Ficus* *elastica,* a semicircle of transparent small points may be seen beneath the inferior bundles of the petiole and above the superior ones.

In most plants the tissue enclosing the cortical tubes may be easily separated from the spiral vessels, and the proper vessels be readily and distinctly demonstrated. It must therefore be supposed that they represent an entirely different histological constituent, and the more so because we know that the liquids they contain are also of a different character.

We therefore conclude that the tubes met with in the greater number of plants, enclosing transparent and granular fluids, have not the structure of proper vessels: they are not ramified; they do not anastomose and form a network; they are, on the contrary, analogous to fibrous tubules, and shade off into them; they occupy the same position; their walls are proportionately thicker as they grow older; they are straight, simple, aggregated in bundles, and have acute or rectangular extremities placed in apposition with those of similar tubes so as to form filaments or fibres, but not a vascular system or network; lastly, they all contain the same sort of fluid. They occur not only in non-lactescent plants, but also in those possessing coloured juices and vessels. They must therefore be regarded as distinct from the last-named reservoirs. They constitute the commencement of fibrous tubes, shade off into them, and progressively assume all their characters.

We do not go so far as to assert that vessels anastomosing to form a network, and containing granular uncoloured juices, are never to be met with. The immense varieties of vegetable products justify the belief that the juices contained in the vessels need not necessarily be always coloured by the granules they hold in suspension; indeed it is a fact, remarked in the case of certain lactescent plants, natives of tropical climates, that the coloured juices are absent from them when grown in our climate; that is, they fail to secrete, under the influence of a lower temperature, those juices marked by a higher degree of elaboration. Nevertheless they retain the special apparatus belonging to them, and the only change is that the liquids they contain do not possess those properties that they would have acquired had their vital activity been sustained in full vigour. The circumstance we have sought to show is, that the tubes of plants normally devoid of coloured juices do not seem the analogues of proper vessels.

In our opinion, therefore, it is sufficiently demonstrated that a vascular system like that existing in animals, concerned in transporting and distributing the nutritive juices prepared by special organs, is not found in plants: the proper vessels themselves do not possess this character. If they do constitute capillary anastomotic tubes at their origin, this condition does not last.

The spiral vessels have closed extremities, and anastomose; if they communicate with each other, it is an accidental circumstance. They are adapted by their length to serve as channels for the rapid transmission of liquids to a great distance; but they do not disperse or diffuse them except so far as the permeability of their walls permits.

The cortical tubes and fibres, which are only modified conditions of the same structure, present a similar disposition: they are closed at their extremities, and by intermediate phases approximate in characters with cells; their walls are permeable only to liquid substances.

The appellation *latex* cannot advantageously be applied to the liquid they enclose, for the name has been given to juices essentially different: nor can the name *laticiferous vessels* be given to these tubes, for they are not vessels in the usual signification of the word; it has, moreover, been employed to designate channels of another description. The expressions *latex* and *laticiferous vessels* seem to me calculated only to cause confusion in science, and to be rightly rejected; they perpetuate an erroneous idea, by assigning to plants those centralized functions peculiar to animals. In plants, all the organic constituents possess an individual life, and concur in the maintenance of the common life; all, even to the cells which compose the simplest hairs, are organs of transmission and the seat of processes of elaboration; in all, the fluids undergo movements of cyclosis or of gyration, and the materials peculiar to nutrition are prepared by a process which combines the elementary principles, or separates those which are hurtful or useless. Every single cell or vessel thus creates the substances which are required for its growth; each allows the transudation of those materials which form, in contact with its walls, the new tissues which preserve unchanged the characters of the species, even when the mass of elaborated juices is derived from another species grafted on the plant; lastly, each one is able to supply juices to distant parts, just as it has itself received such from them.

XXXV.—*Third Account of new Species of Snakes in the Collection of the British Museum.* By Albert Günther, M.A., M.D., Ph.D.

[Plates V. & VI.]

The following species of Ophidians have been added to the Collection of the British Museum since the publication of